

Integrated Pest Management in Avocado Orchards



What is IPM?

- **Management strategy for insect pests**
- **Key features**
 - Regular monitoring
 - Combination of control methods
 - Minimising disruption of beneficials & impact on the environment
 - Pesticide use based on monitoring results **and orchard history***



IPM - What does it involve?

- Monitoring your orchard frequently & regularly
- Knowing your enemies & your friends - ID key pests
- Correct identification of pests and beneficials
- Understanding life cycles & seasonal occurrences
- What to look for, and when – related to plant phenology
- Tolerate minor damage



IPM - Key themes

- Low pest numbers may be tolerated
- Determine pest threshold levels
- Targeted chemical spray when necessary
- It may be possible to effectively treat only hotspots
- Provide refugia for beneficial insects
- **Healthy well-managed trees are less prone to attack??**



IPM – Control*

- **Insecticide choice**

- Persistent, broad spectrum insecticides eliminate beneficials
- Apply specific, less disruptive insecticides if available e.g. Mimic for loopers / caterpillars; oil for scales
- Encourage natural biological controls

- **Provide refugia for beneficials?**

- Non sprayed shady trees and crops and weeds
- To provide suitable food to survive and reproduce in the crop's vicinity
- Species that don't host pests (host-specific parasitoids??)



Why adopt IPM?

- A better way to manage pests
- Consumer resistance to old chemicals
- Many older chemicals are being phased out
- New chemicals are very expensive
- May improve profitability by reducing unnecessary inputs



A Short Quiz

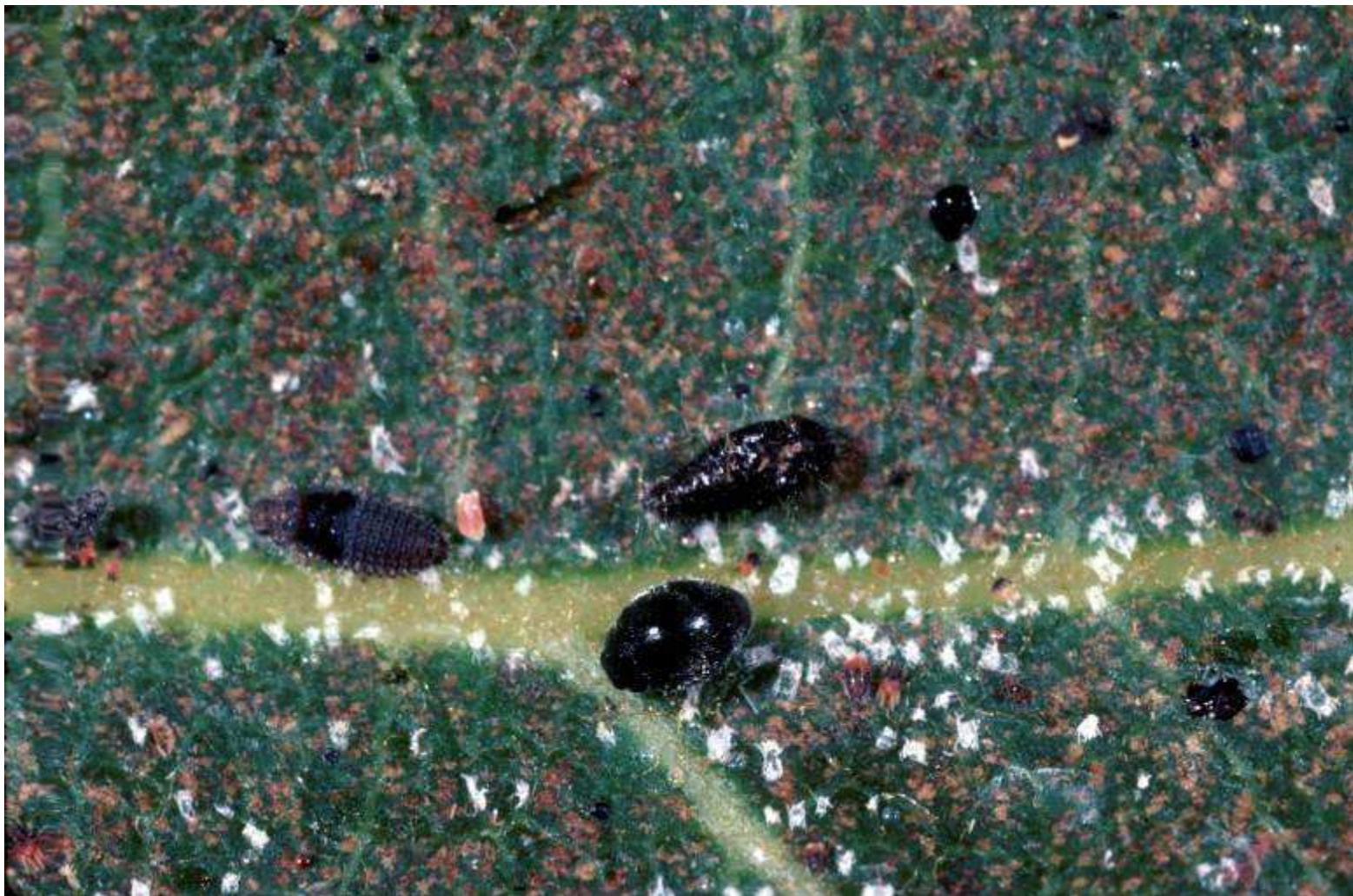
1. In which group of insects would you place this insect [e.g. fly, grub, wasp, beetle etc.]
2. Is this insect:
 - a. a pest
 - b. a beneficial insect
 - c. neither - it is just sitting there



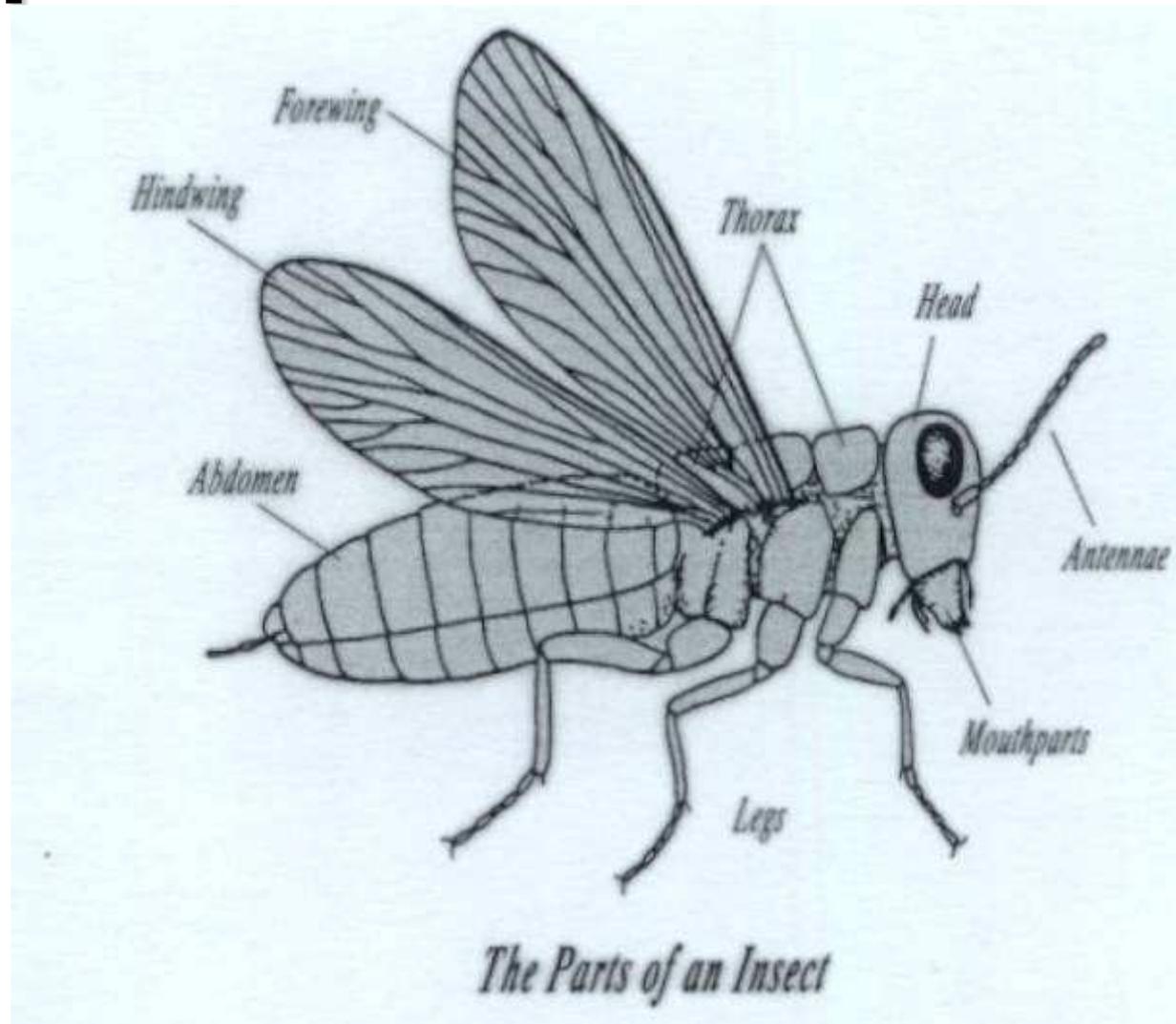








The parts of an insect

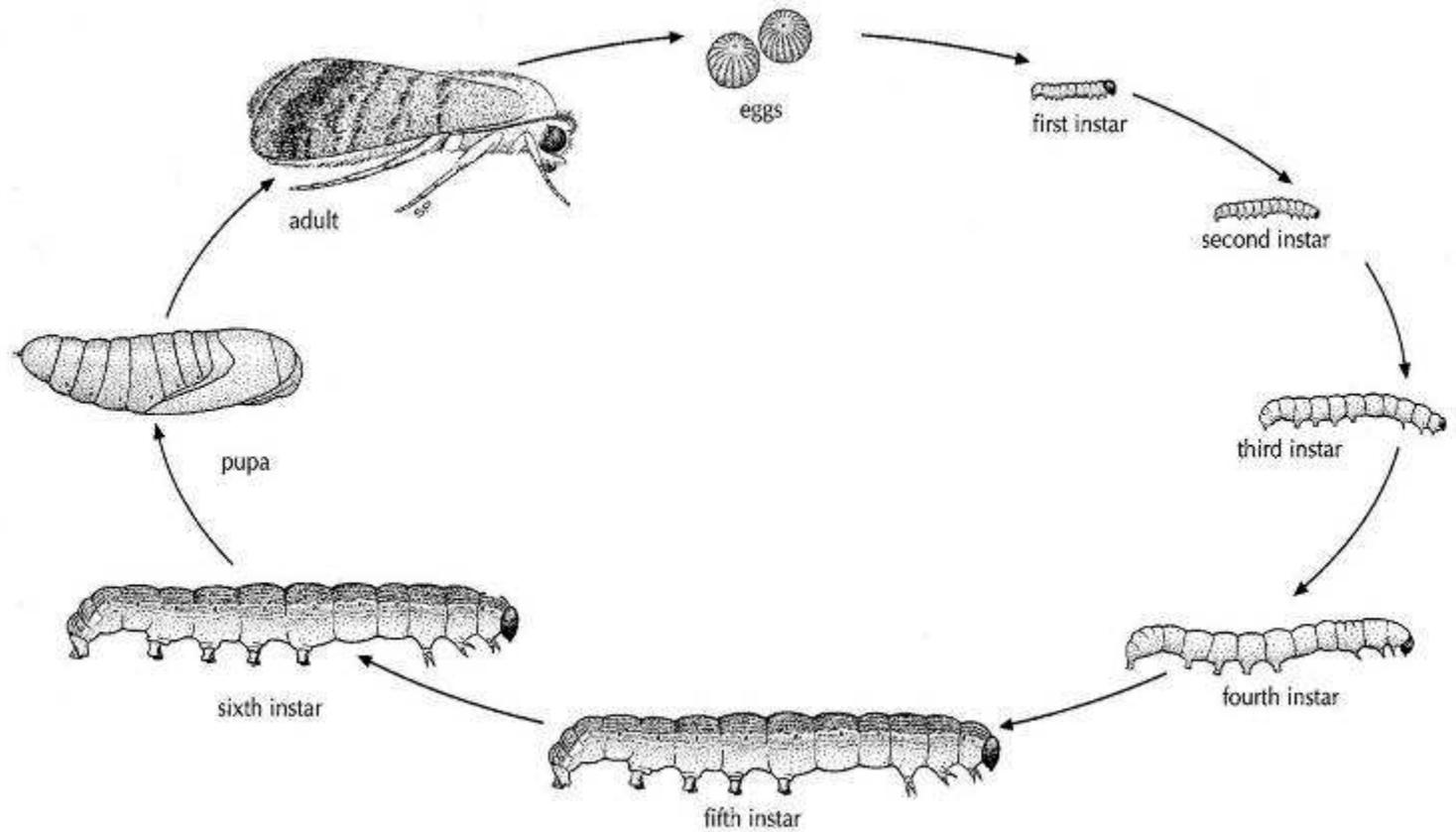


Complete lifecycle

- **4 stage lifecycle (egg, larva, pupa, adult)**
 - Adults & immature stages are different
 - Pupal stage: larva changes to adult form
- **Feeding: Adults & immatures**
 - Have different types of mouthparts
 - May feed on different food sources
 - Avoids competition between different growth stages
- **Control**
 - Larval stage is the most susceptible to control – less mobile, but is also often the damaging stage

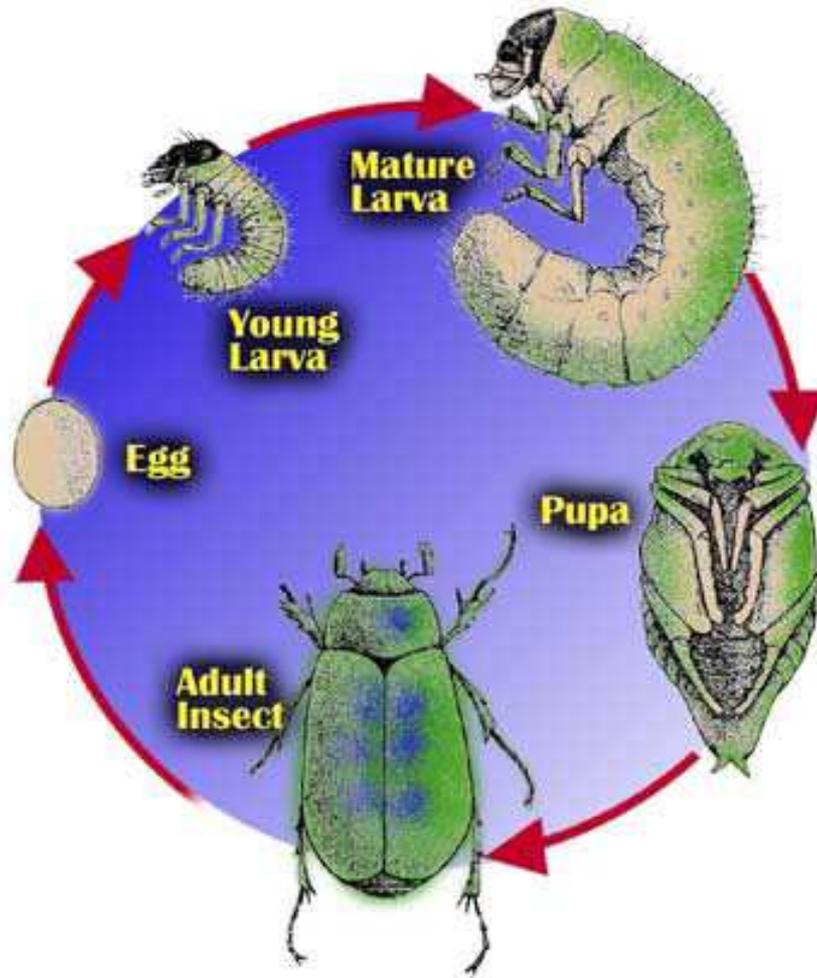


Complete lifecycle

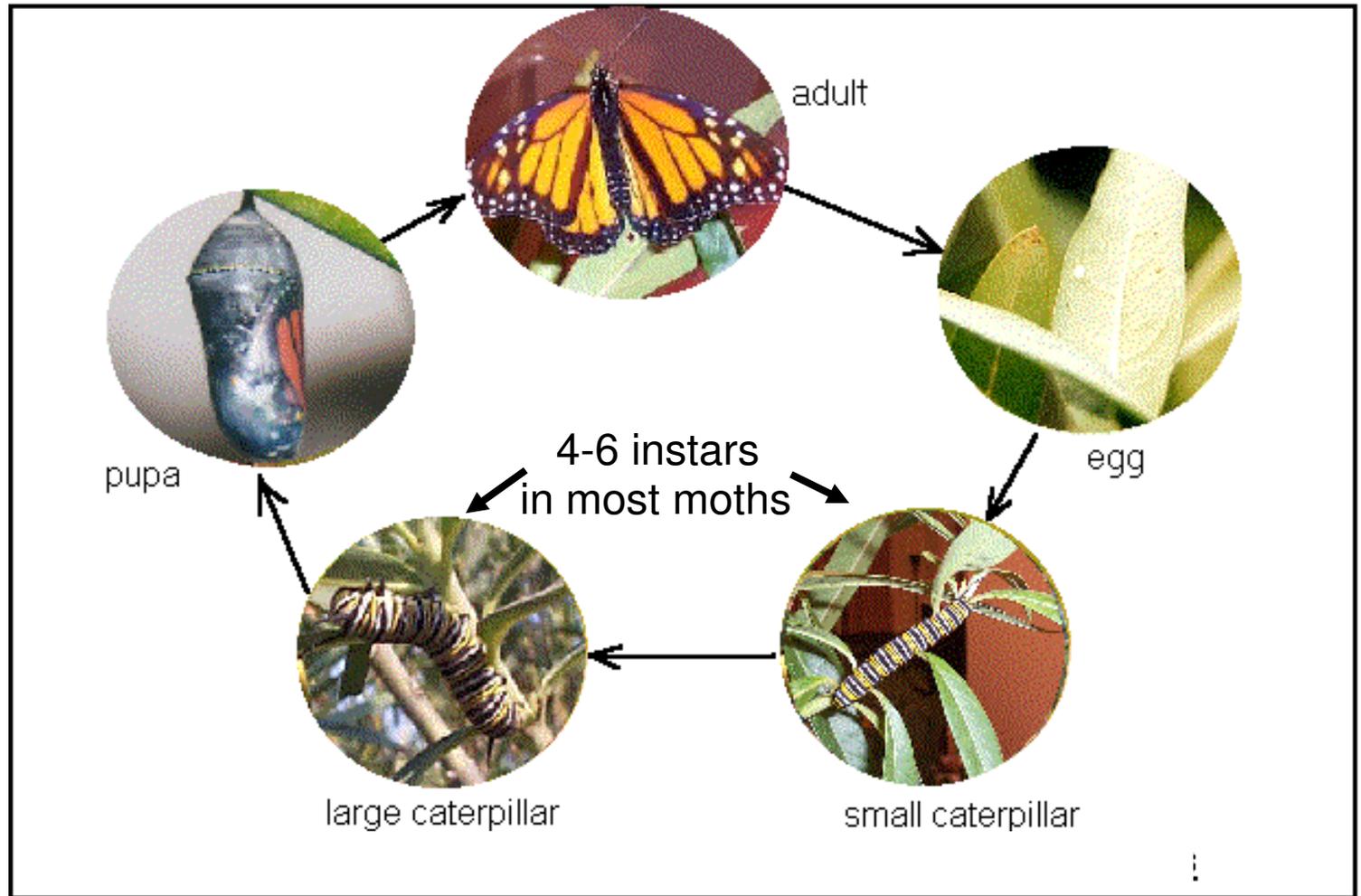


butterflies, moths, beetles

Complete Metamorphosis



Life stages of the monarch butterfly, *Danaus plexippus*

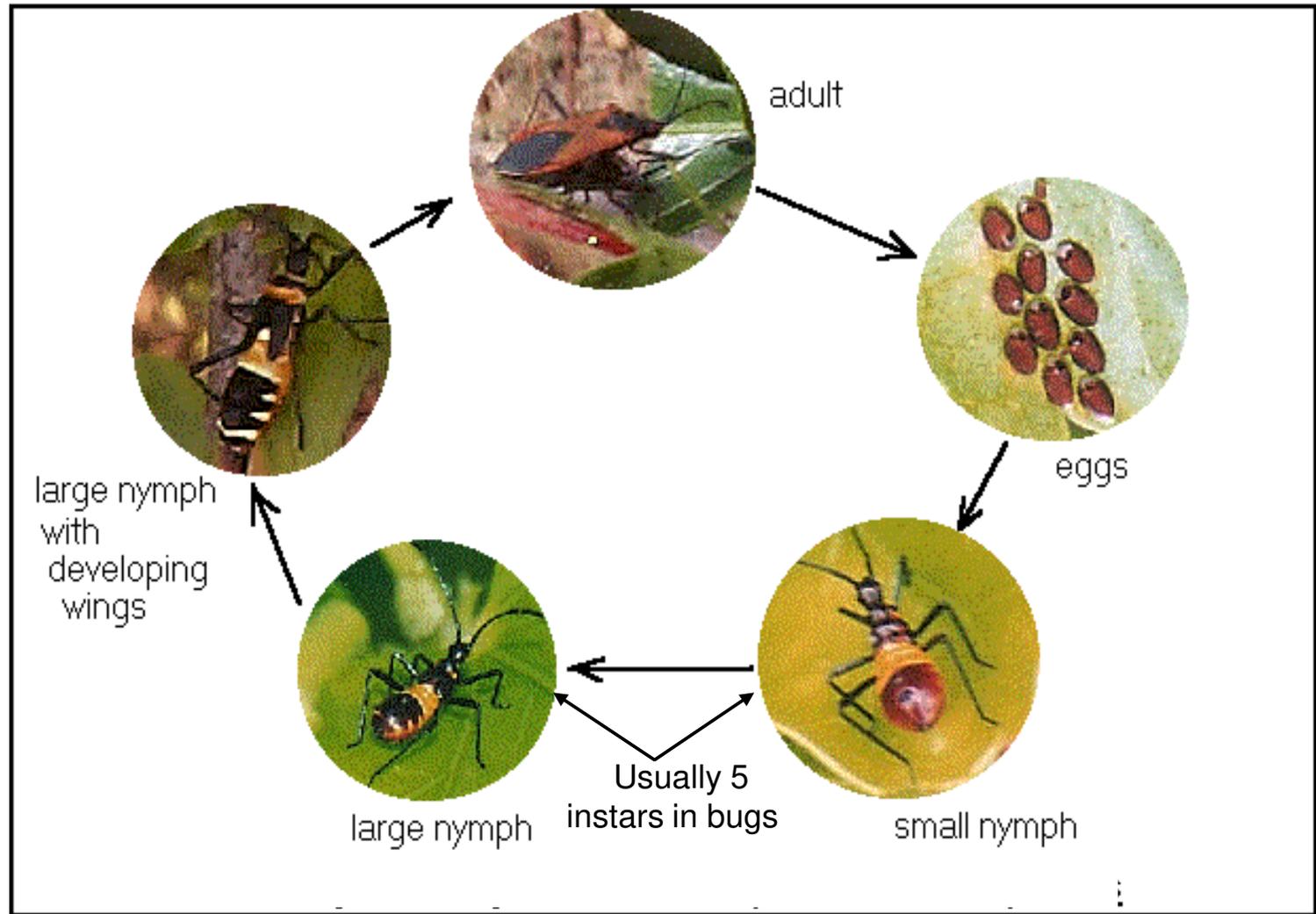


Incomplete (gradual) lifecycle

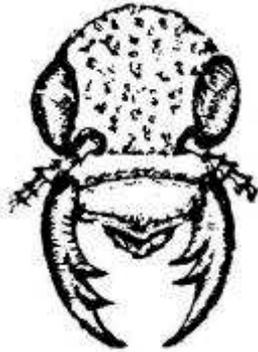
- **3-stage lifecycle**
 - Immature insect resemble adults
 - Immatures referred to as nymphs
 - No pupal stage
- **Feeding: Adults & nymphs**
 - Same mouthparts
 - Utilise the same food and resources
 - Occur in the same habitat and cause similar damage
- **Management**
 - All life stages susceptible to natural enemies and chemicals



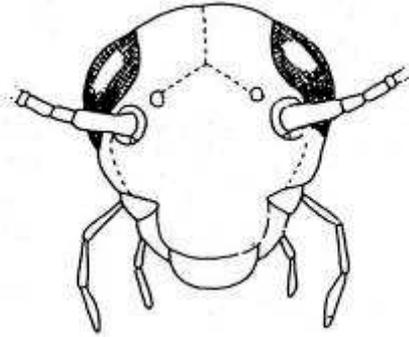
Incomplete Metamorphosis



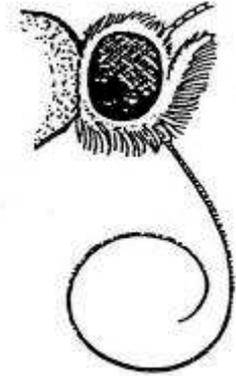
Insect mouthparts



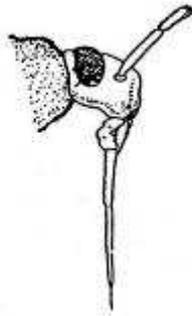
Chewing mouthparts



Coiled sucking mouthpart



Piercing mouthpart



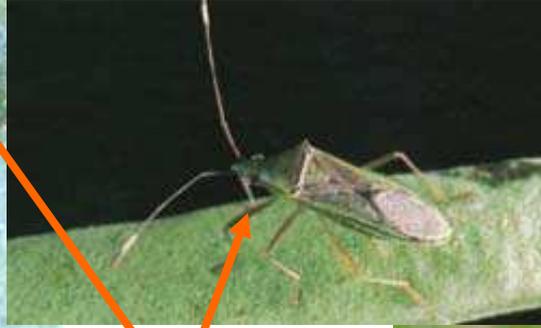
Sponging mouthpart



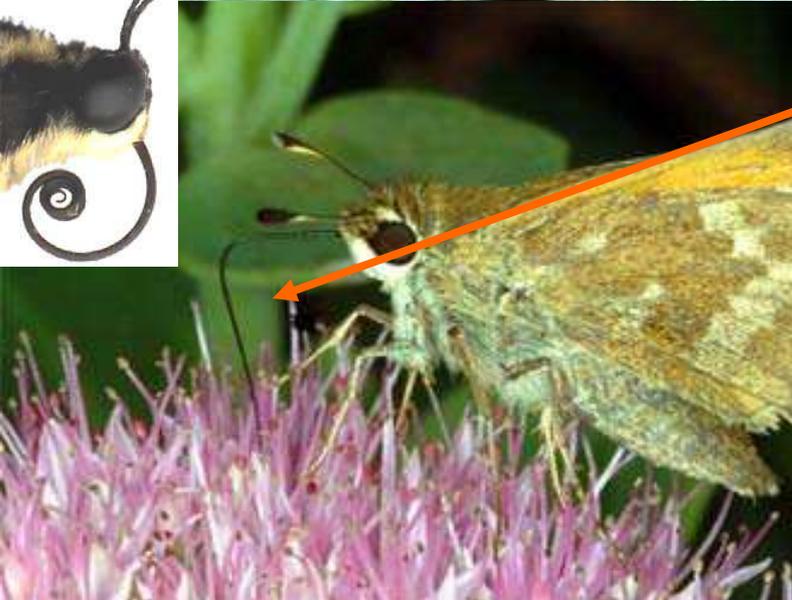
Insect
mouthparts



Chewing
Beetles, ants, termites,
grasshoppers



Sucking
Bugs, aphids,
butterflies
and moths,
mosquitoes



Lapping
Flies

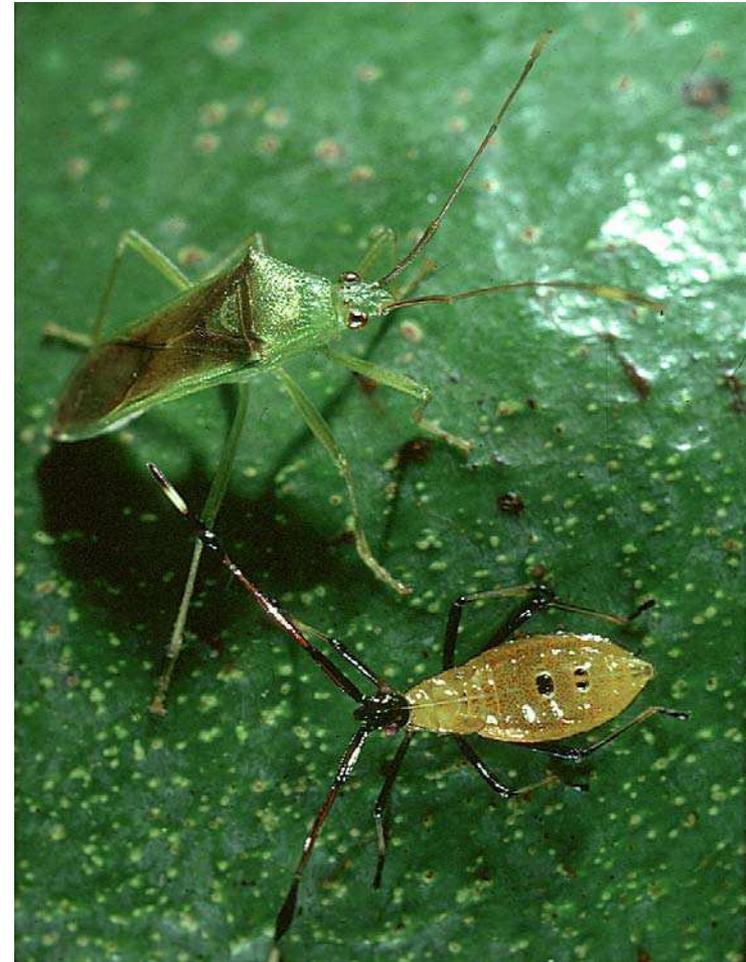
Bugs, scales, aphids (Hemiptera)

- Incomplete or 3 stage life cycle
- Sucking or piercing mouthparts
- May be pests or beneficial

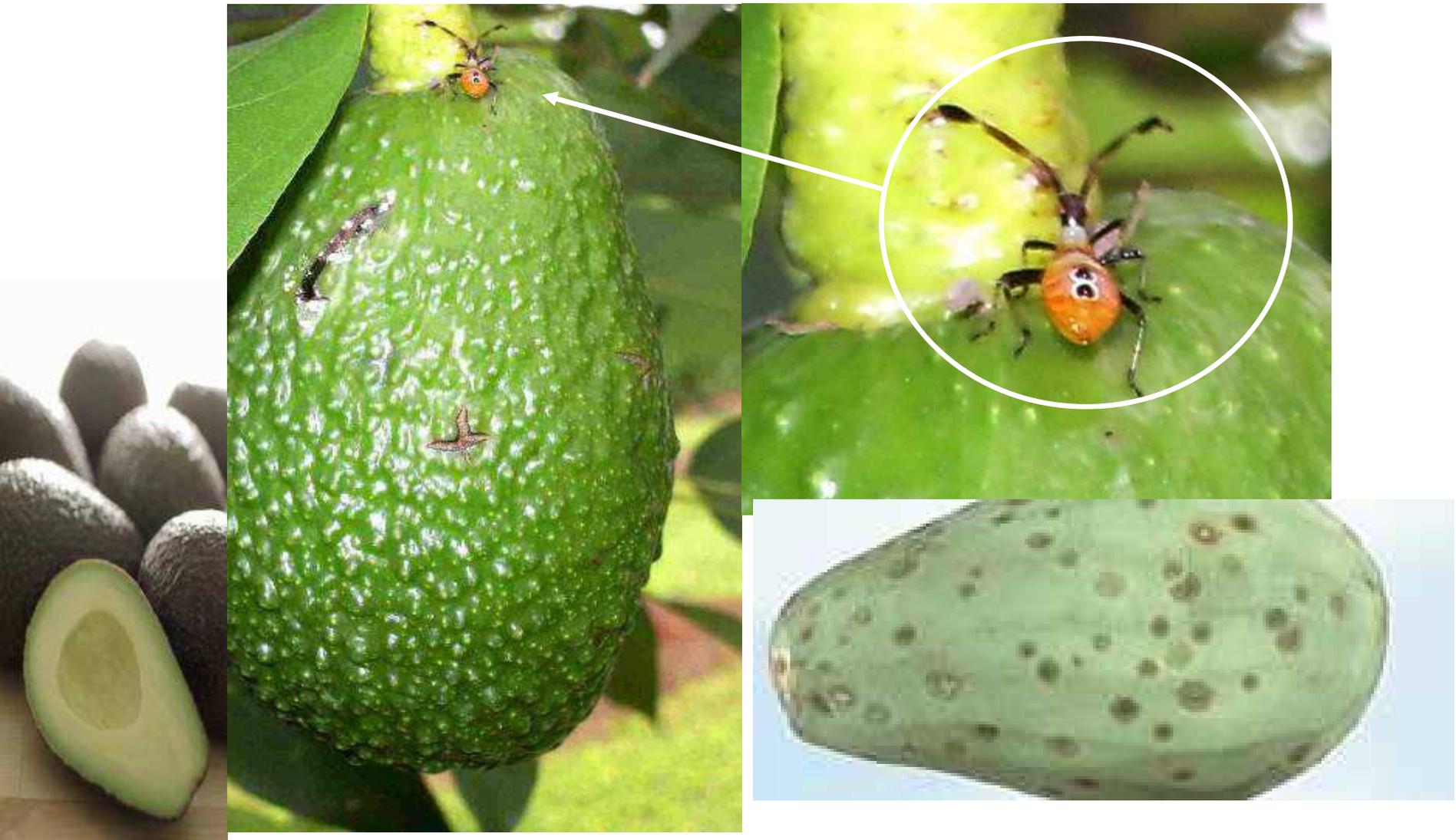


Fruitspotting bug (*Amblypelta* spp.)

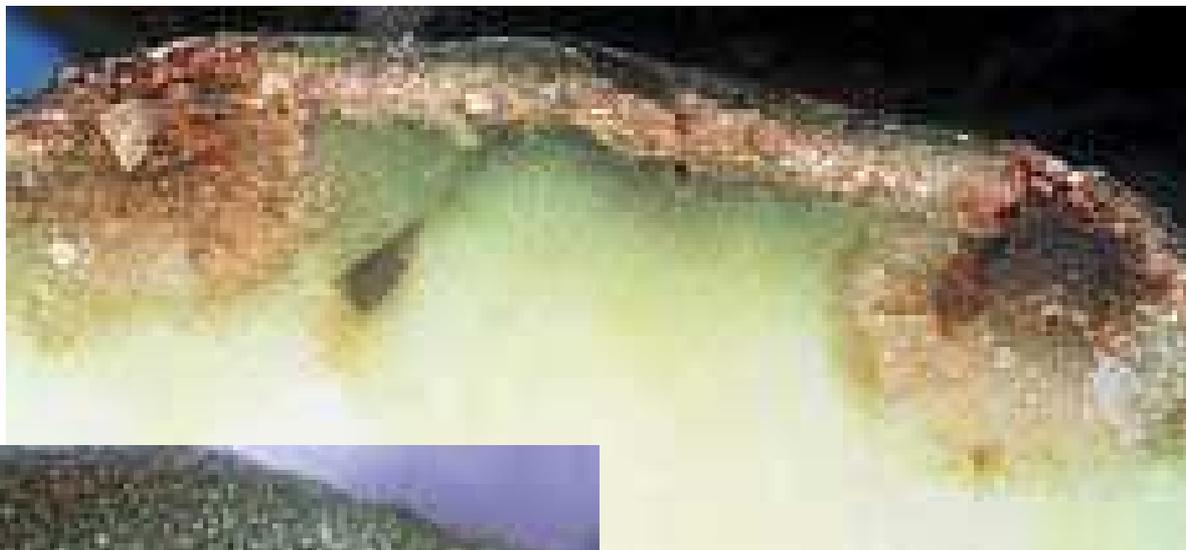
- Attracted to green fruit
- Feed by piercing fruit, injecting enzymes and sucking liquefied cell contents
- Fresh damage looks like a small bruise in the flesh – cracking ensues as fruit expands around dead tissue
- Young damaged fruit may drop, older fruit is retained on the tree and may rot



Fruitspotting bug damage



Fruitspotting bug damage



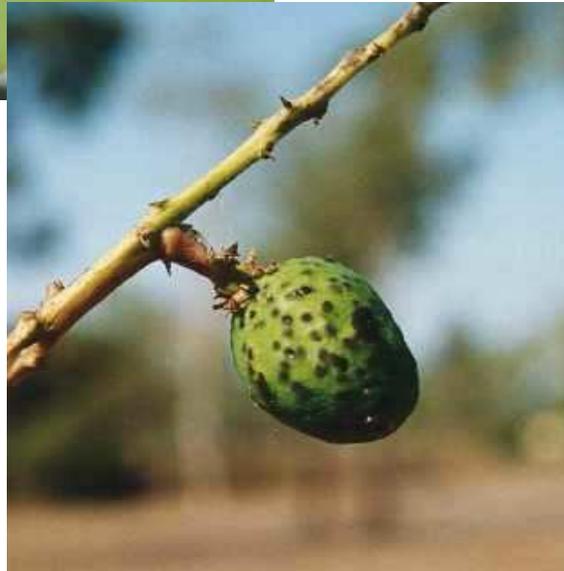
Fruitspotting bug monitoring

is very difficult!

- Monitor for bug damage, bugs are elusive
- Monitor weekly from fruit set
- Fruit in tree tops generally worst affected – spray deprivation?
- Monitor near bushland or hotspots known from previous years
- Use orchard history to anticipate infestation



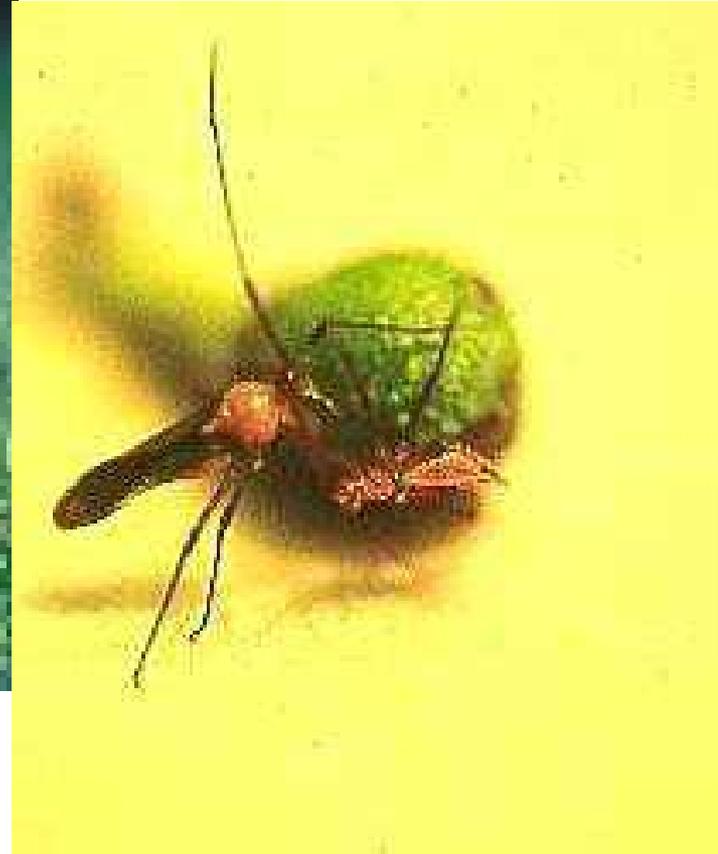
Tea mosquito bug (*Helopeltis*)



- Adults and nymphs feed on new growth, leaves and young fruit
- Feeding causes small black spots
- More superficial than spotting bug
- Rarely affects older fruit
- Sporadic pest



Tea mosquito bug (*Helopeltis*)



Taylorilygus sp.

- Pest species in avocados as yet unnamed
- 4 named species in Australia
- *Taylorilygus apicalis* - predatory and phytophagous in cotton and vegetables
- *Taylorilygus nebulosus* - widespread but may be a complex of several species
- Known only from Walkamin south
- Don't slash grass during early fruit development



Taylorilygus feeding damage

Exudate

Pimples

Irregular shape



1

cm
Developing



Courtesy of ARC-LNR

Developing



3 cm

Mature

Taylorilygus sp.

Similar species in Australia

Apple dimpling bug



Campylomma liebknehti

Brokenbacked bug



Taylorilygus apicalis



Assassin bugs

- Predators of many insects but are 'lazy'



Predator or pest?



Predatory shield bug

- Predator of loopers & caterpillars

Oechalia schellenbergii



Latania scale

- Infests leaves, shoots & fruit
- More serious in later fruit
- Infestation downgrades fruit
- Broad spectrum insecticides and Surround® may increase incidence
- Can be effectively suppressed by natural enemies



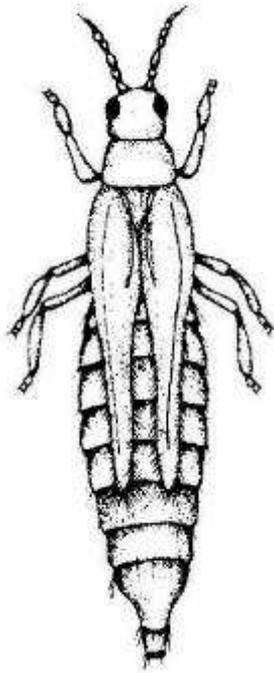
Planthopper



- Suck sap from shoots, flowers and fruit
- Sooty mould on leaves, branches & downgrades fruit



Thrips (Thysanoptera)



- 0.5-15mm in length
- Cylindrical elongated body
- 2 pairs of wings that are long and slender
- Mouthparts can both rasp and suck



Redbanded thrips

Selenothrips rubrocinctus

- Minor damage may be confused with wind rub



Preying mantids (Mantodea)



- Incomplete lifecycle
- Chewing mouth parts, carnivores
- Triangular shaped head
- Raptorial fore legs
- General predators



Lacewings (Neuroptera)



Mallada signata

green lacewing



- All stages predators
- Larvae have piercing mouth parts
- Adults have chewing mouth parts
- Excellent, often underrated predators



Lacewing larvae



Beetles (Coleoptera)



- Complete lifecycle
- Chewing mouth parts
- Forewings hardened to form protective cover – elytra
- Pests & beneficials

Leaf-eating beetles



Rhyparida



Red-shouldered leaf beetle

Monolepta

Leaf-eating beetle damage



- Feed on fruit and leaves

Predatory Ladybirds



- General predators of aphids, mites, scales & mealybugs
- Adults and larvae feed on mites, scale etc.

Cryptolaemus ladybird



- Adults & larvae feed on:
 - Mealybugs
 - Fluted scales
 - Soft green scales
 - Planthopper eggs
 - Other insect eggs and immobile immature stages
- Can be purchased commercially*



Stethorus



- Mite predator
- Very small – 2mm
- Adults and larvae eat mites and their eggs

Butterflies & moths (Lepidoptera)



- Complete life cycle
- Mouthparts
 - Larvae: chewing
 - Adults: coiled sucking or piercing
- Pests & beneficials

Loopers



- 4 species, with 2 main species in FNQ
 - Grey and *Ectropis*
- Damage leaves and fruit
- Can defoliate trees, leading to sunburn on fruit



Loopers



- Several wasp species parasitize loopers
- pathogens
- Softer control options include insect growth regulators and *Bt*

Apanteles sp.



© Jeff Watson



© Jeff Watson

- Looper parasite



Looper parasite - pupa



© Jeff Watson

Avocado fruit borer

- NQ only
- No specific pesticides registered



Leaf Rollers



- Larvae web leaves and fruit together
- Feed on fruit in these shelters
- *Homona spargotis* (NQ)
- *Cryptoptila immersana* (SQ & NSW)



Leafroller parasites and predator



© Jeff Watson

Fruit flies



- Stings cause only cosmetic damage
- Fruit becomes susceptible as size increases
- Quarantine pest domestic & export, even though hard green avocados cannot sustain larvae



Fruit fly or fruitspotting bug?



Fruit Fly vs Spotting Bug

Fruit Fly

- Lesion 3mm deep, or less
- Mainly from fruit equator to base
- Mid to late season as fruit size increases



Spotting bug

- Lesion > than 5mm deep
- Mainly stem end
- From fruit set to April
- Water-soaked areas ('bruises') under skin → gritty 'peas' in flesh at maturity



Wasps, ants and bees (Hymenoptera)



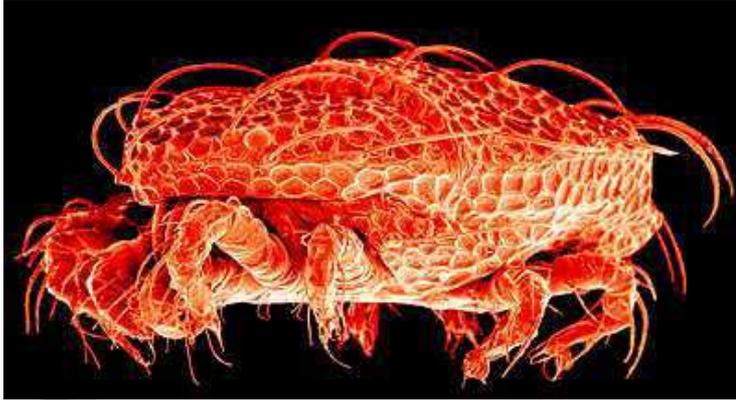
- Complete life cycle
- Chewing mouth parts
- 2 pair of wings
- Many parasitic & some social species
- Beneficials, pollinators & pests

Wax scale parasite (*Anicetus beneficus*)

- Introduced parasites (*Anicetus* & *Paraceraptrocerus*)
- Wax scale now a sporadic pest



Mites (Acarina)



- 2 body sections
- 4 pair of walking legs
- No antennae
- Sucking, rasping mouthparts
- Pests & beneficials



Tea red spider mite



- Destroys green tissue on upper leaf surface
- Leaves turn reddish-brown (bronzing)
- Reduces tree vigour
- Hass, Wurtz and Sharwil most susceptible
- Often a result of disruptive sprays

IPM - monitoring

- Know what's happening in orchard
- Detect infestations early & monitor changes in pest levels
- Correctly attribute damage
- Identify problem areas or 'hot spots'
- Develop an historical record
- Enables application of appropriate management options



Monitoring requirements

- Familiarity with pests and natural enemies
- Check appropriate numbers of fruit/terminals/trees
- Record numbers/damage
- Carry and use a hand lens and knife when required
- Identify any problems and make decision on course of action



What to look for, when!

At fruit set

- Fruitspotting bugs
- Mites
- Scales
- Leaf-feeding beetles

Fruit development

- Fruitspotting bugs
- Leaf-feeding beetles
- Mites
- Scales
- Thrips
- Loopers
- Leafroller
- Fruit fly



Acknowledgements

- Matthew Weinert
- Chris Freebairn
- Stef De Faveri
- Harry Fay
- Geoff Waite
- Jeff Watson
- Simon Newett
- Shane Mulo
- Ross Storey
- Leonie Wittenberg

